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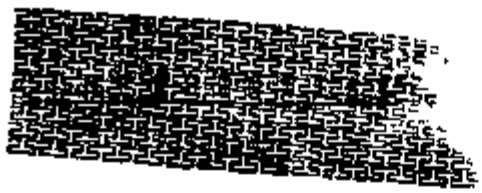


Contract Number AT-33-1-GEN-53

MOUND LABORATORY
Operated By
MONSANTO CHEMICAL COMPANY
MIAMISBURG, OHIO

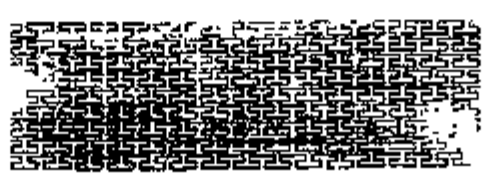
M. K. Haring
Laboratory Director

SAMPLES OF SOIL FROM ARCO, IDAHO

(Information Report)

Date: November 22, 1949

Prepared By: G. D. Stewart



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Samples from a single drilling made at Arco, Idaho were submitted to this laboratory in order to determine the adsorptive capacity of soil at Arco, Idaho for radioactive elements.

These samples were tested by treating them with a solution of neutralized second-cycle Hanford wastes (commonly known as crib wastes), whose estimated age is three years. The solutions contained radioactive cesium, ruthenium, tellurium, and antimony. The following procedure was used: Four-tenths gram of each soil sample was powdered and shaken for one hour with ten milliliters of the waste solution. The mixture was then centrifuged and one milliliter of the centrifugate was counted with the use of an Eck and Krebs Geiger-Mueller tube.

The per cent of activity removed is shown for each sample in Figure 1. The average per cent for each stratum is shown in Table I. In column 2 of Table I is listed the depth for each stratum.

As is clearly shown in Figure 1, the soil with the greatest adsorptive capacity is hard brown lava at a depth of approximately 410 feet. In order to estimate the total capacity of the hard brown lava, one-gram samples of this material were successively shaken with 25-milliliter portions of the crib wastes. The relative percentages removed are given in Table II.

It is apparent that the percentage of activity removed falls off to a constant value of ten per cent after the second treatment. This corresponds to the behavior of the crib waste solutions in other experiments carried out by this laboratory. We have found that under neutral or slightly acid conditions, silica may be easily formed, and that ten per cent of the activity initially present in that solution is always associated with this silica. This activity is found to consist almost entirely of ruthenium. In the treatment with hard brown lava, the silica was removed.

An analysis of the supernatant solution for cesium and insoluble sulfides (ruthenium, antimony, and tellurium) was made on the supernatant solution from the first experiment in Table II. The results of these analyses are reported in Table III. We have also recorded in Table III, experiments carried out by us with Attapulgus clay. This clay is used at Oak Ridge, Tennessee (C.F. Report No. K-443) and by us for the removal of cesium from crib waste solutions. It is apparent that hard brown lava has nearly the same capacity as the Attapulgus clay. It has also been found by us and by Carbon and Carbide at Oak Ridge, that much better results are obtained when Attapulgus clay is used in a column-type operation. We would conclude that because the seepage of liquid wastes into the soil is a column-type operation, excellent results would be obtained at Arco, Idaho if the liquid wastes are allowed to seep into the hard brown lava at a depth of approximately 410 feet.

We have examined the sand at Hanford and find that its capacity is approximately that corresponding to the stratum of quicksand, black lava, and cinders at Arco, Idaho. From this, it can be concluded that the soil in the area of Arco, Idaho has, in general, a much higher adsorptive capacity for radioactive elements than that of the Hanford Works.

Table I

RELATIVE CAPACITY OF SOIL

Types of Soil	Depth	Per Cent Activity Adsorbed
Top Soil	15' - 16'	24
Blue, Brown Lava	16' - 95'	10
Fine Dark Brown Lava	95' - 150'	18
Gray Clay and Broken Lava	155' - 175'	21
Cinders, Black Lava	175' - 215'	15
Brown Lava	215' - 245'	20
Red Lava	250' - 255'	24
Dark Brown Lava	260' - 305'	15
Clay and Gravel	310' - 335'	13
Yellow Clay and Lava	340' - 390'	18
Hard Brown Lava	395' - 425'	25
Hard Blue Lava	425' - 615'	18
Extra Hard Blue Lava	615' - 640'	9
Quicksand	640' - 642'	1
Black Lava	642' - 680'	3
Porous Red Lava	685' - 865'	9
Black Cinders	870	0
Lava, Cinders, Sand, Clay	875' - 980'	13
Lava and Clay	980' - 1078'	19

[redacted] UNCLASSIFIED

Table II

CAPACITY OF HARD BROWN LAVA ON SUCCESSIVE TREATMENTS

No. of Treatments	Per Cent Activity Removed
1	25*
2	17**
3	10**
4	10**

* Average of 22 samples

** Average of 7 samples

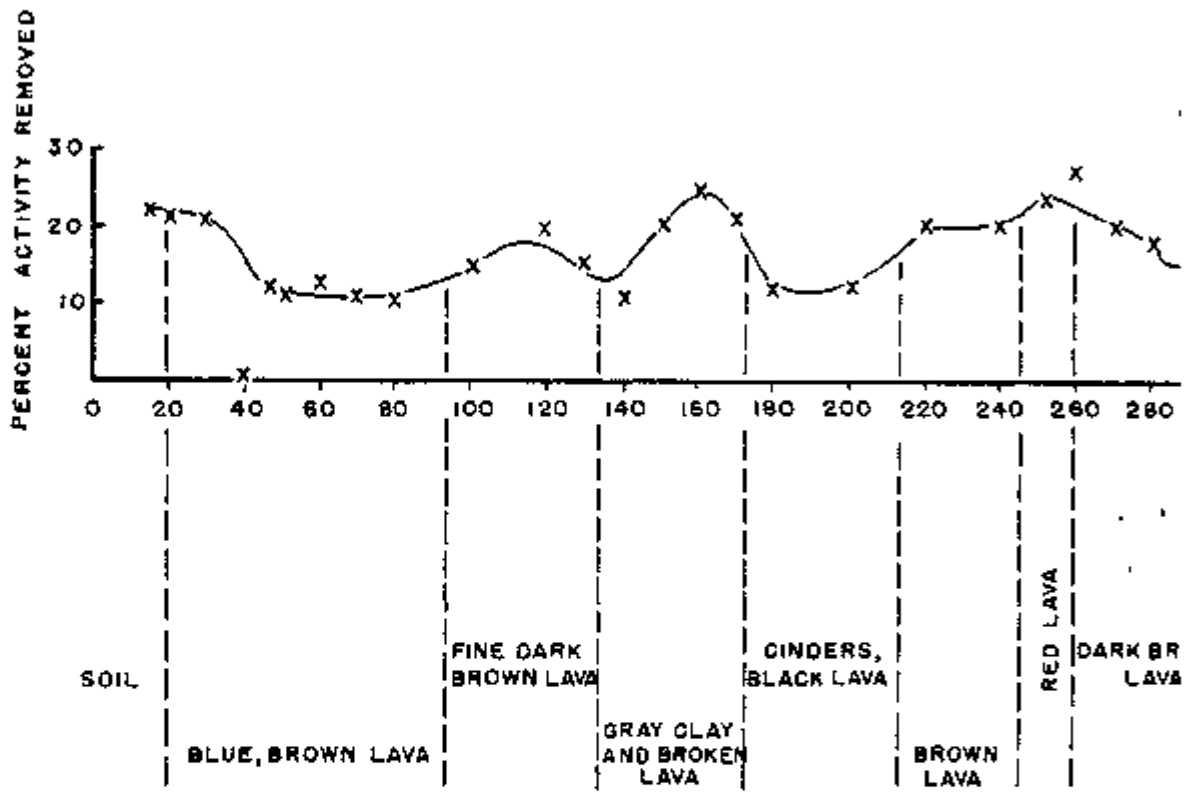
Table III

ANALYSIS OF ACTIVITY REMOVED BY HARD BROWN LAVA

Radioactive Elements	Per Cent Initially Present	Per cent of Each Element Removed by Lava	Per Cent of Each Element Removed by Attapulgus Clay
Cesium	40	40	54
Ruthenium, Antimony, and Tellurium	60	15	
Total	100		

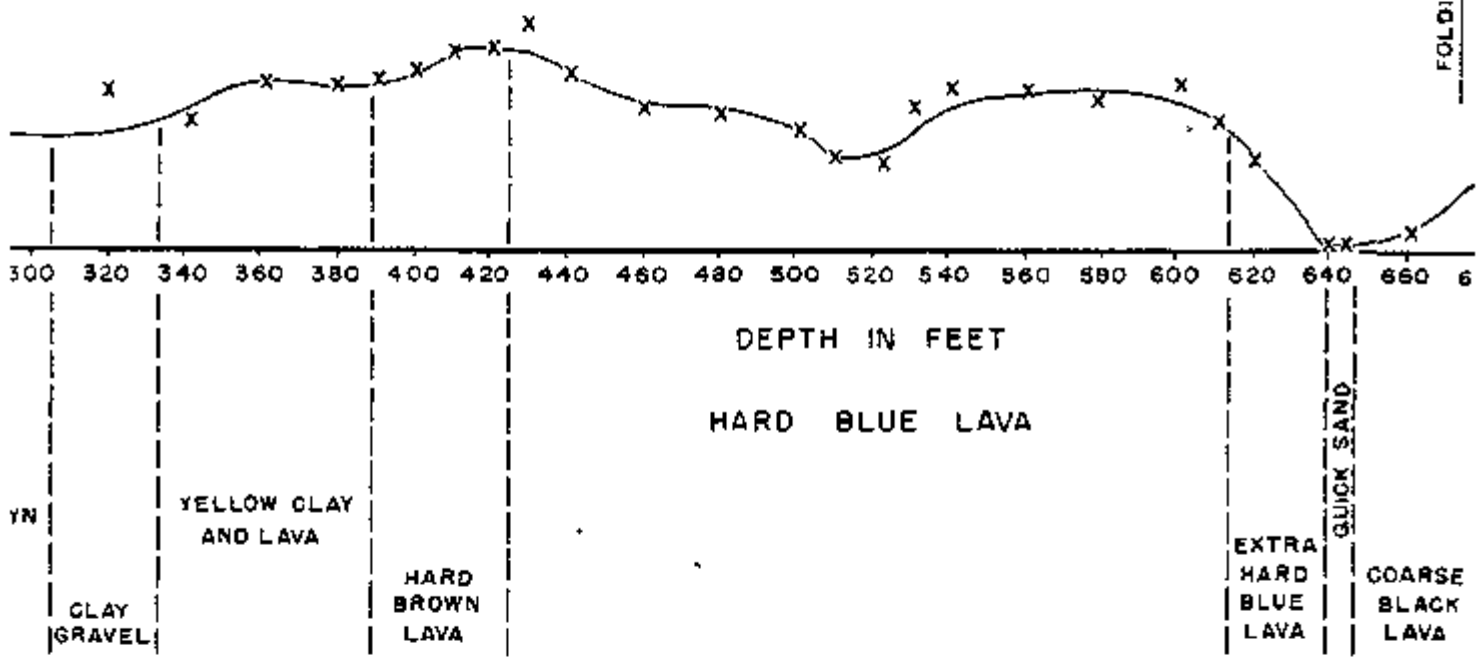
GDS/pjr

[redacted]


PERCENT ACTIVITY REMOVED
30
20
10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
SOIL
BLUE, BROWN LAVA
FINE DARK BROWN LAVA
GRAY CLAY AND BROKEN LAVA
CINDERS, BLACK LAVA
BROWN LAVA
RED LAVA
DARK BR
LAVA

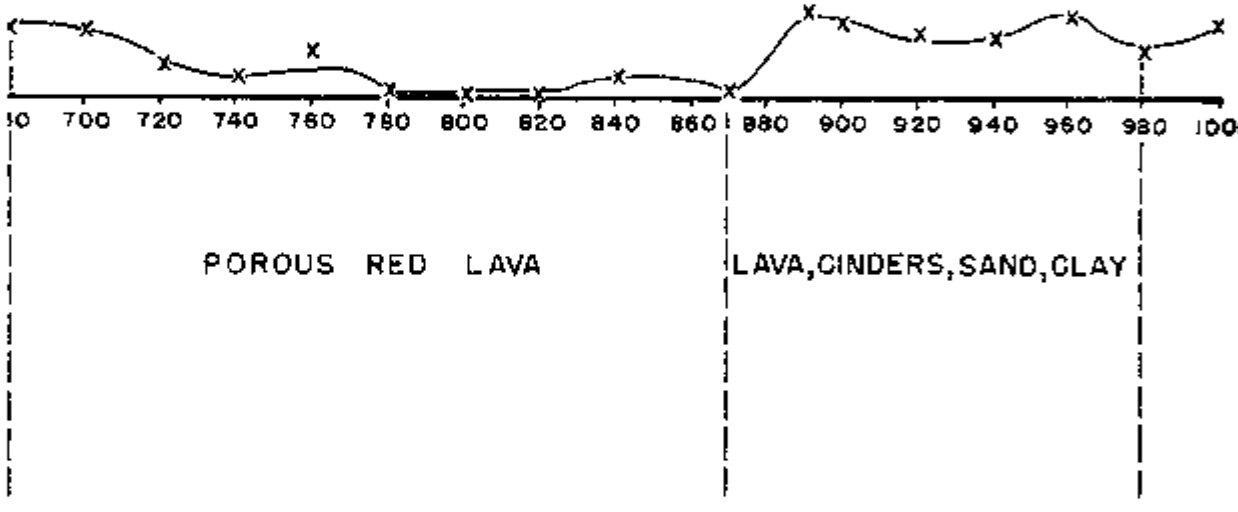
PERCEI

FIGURE: 1



T ACTIVITY REMOVED BY SOIL SAMP
FROM VARIOUS DEPTHS.

FOLDING LINE


700
720
740
760
780
800
820
840
860
880
900
920
940
960
980
POROUS RED LAVA
LAVA, CINDERS, SAND, CLAY

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